etdips v2.00 Reference Sheet

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etdips Opening Screen

Object View

- Base coordinate frame.
- Origin at center of volume.
- Mouse
  LEFT: Rotate
  RIGHT: Reset Rotation
  SPACE-LEFT: Pan
  SHIFT RIGHT:
  Print/Mail/Save/TriPlanar & Model display options
- MouseWheel/Arrow Keys: Zoom View
- For proper orientation control, ($-x_{min}$, $-y_{min}$, $-y_{min}$) must correspond to the patients's (posterior, right, top).
- Depicts object rotation, lighting, and VOI.
- Allows control of object rotation using Left mouse button. Holding down the SHIFT key while rotating constraints the rotation to about a single axis.

Application Menu

- File: To open/close **one or more** volume datasets, and set user options.
- View Switch between Classic (As show here) or Traditional 4-panel view (3D/A/C/S)
- Tools: To activate Animation controls & PlugIns (Refresh the list of plugins available)
- Volumes: Mirror Slices, Rows, and columns. Switch between multiple volume datasets
- Help: To access information on the application, registration codes and its Release Notes.

ToolBox

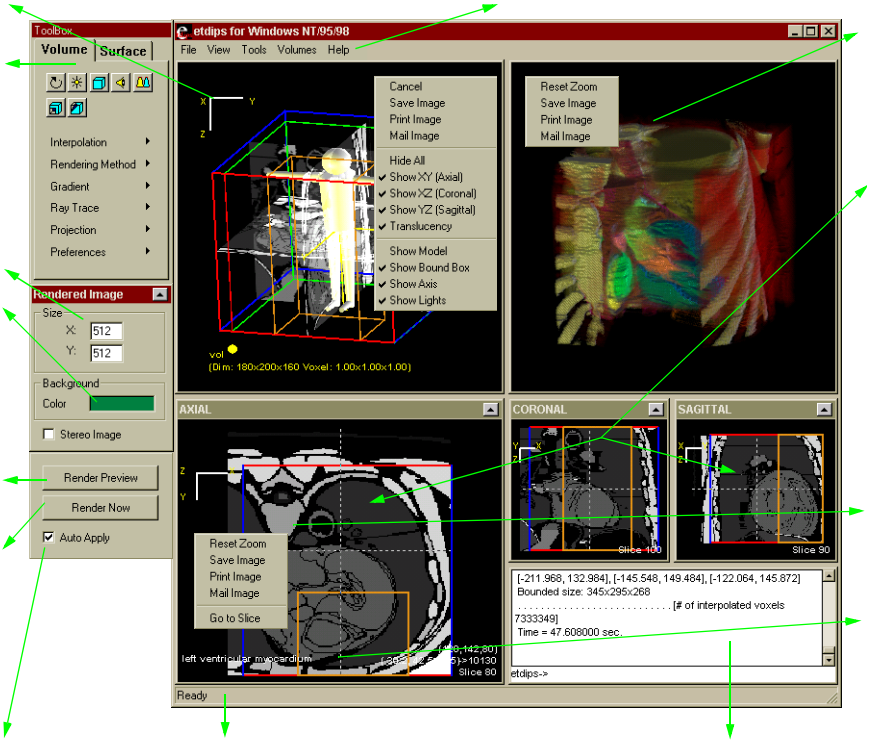
- Allows switching between volume rendered and surface rendering mode. Possible future extensions: volume registration, image analysis, etc.
- Dockable with application window

Image Settings

- Rendered images X,Y size
- Background color
- STEREO (Red-Blue) rendering option

Render Controls

- Render Preview: Provides a quick preview of the rendering incorporating all the user settings. User can specify the level of preview in the FILE menu.
- Render Now: Final button to invoke the volume rendering
- Auto-Apply: If checked, any changes made in any of the control menus is used for the render. Hitting the Apply button in each dialog is unnecessary



Rendered Image

- Mouse
  LEFT(Click): Show corrsponding point in Slice Views [in **Front-to-Back Hybrid** rendering mode only]
  RIGHT-Move(l-R): Zoom
  LEFT: Window/Level
  SPACE-LEFT: Translate
  SHIFT-RIGHT:
  Print/Mail/Save/Reset Zoom
-

Slice Views (A,C,S)

- Option to open or close any view
- Double Click mouse in any view to bring to left main window.
- Mouse
  RIGHT: Zoom
  SPACE-LEFT: Pan
  LEFT: Window/Level
  LEFT on white cross lines to move slices in other views.
  SHIFT-RIGHT:
  Panel to Save, Print, EMail, current Slice view or move to a specified slice, Reset Zoom.
- Arrow Keys/MouseWheel: Allow user to view the previous or following slice in the present view (A,C,S) of the volume.
- If segmentation map (AMAP) loaded, anatomical name corresponding to location of pointer displayed.
- x,y,z position & intensity value shown.
- VOI extent shown in red and blue. See example of it use in Surface Rendering.
- DICOM header displayed

Current Status

- Shows the present status of the render job being processed.

Other Features

- Completely adjustable window configuration. Handles between windows allow this control. All Dialog boxes dockable on both sides of the main window with Minimize/Maximize options. (See **`Surface View`**, Page 4)

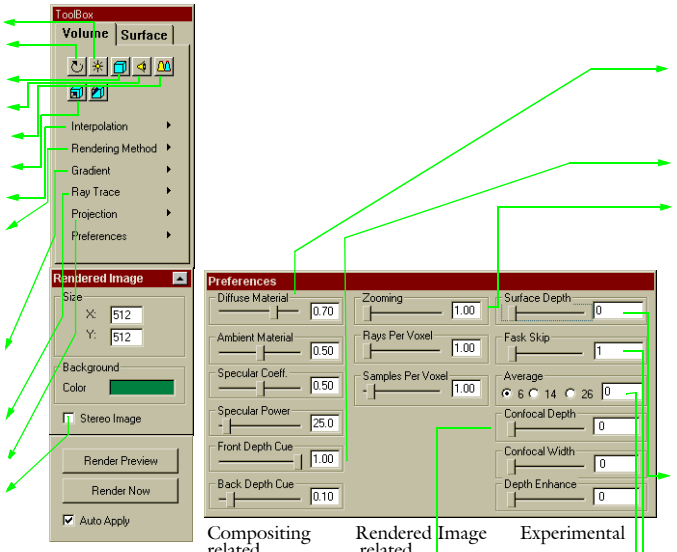
Console Window

- Complete access to the visualization and image analysis API using a command line interface. At the prompt "**`etdips->`**" type**`?`** for help on usage and a list a commands.

Volume Rendering ToolBar

Volume Rendering Controls

- Light control
- Rotation control
- Volume of Interest control
- Perspective Viewpoint control
- Opacity/Color/Segmentation Tree controls
- SubVOI (Cut Away View setting) controls
- Interpolation Option: None OR Tri-Linear
- Rendering Method setting: Ray-casting (Hybrid), Partitioned Ray-casting (Partitioned), X-ray, Maximum-intensity projection (MIP), Realtime (Mitsubishi RTVIZ card required.)
- Gradient Computation Modes: Zucker-Hummel, 6-neighbor, Adaptive, 3D-Sobel, Others.
- Ray-trace options: Front-to-back (F2B) OR Back-to-front (B2F).
- Projection: Orthogonal OR Perspective
- Stereo option: To render image as a red-blue stereo pair.



Preferences

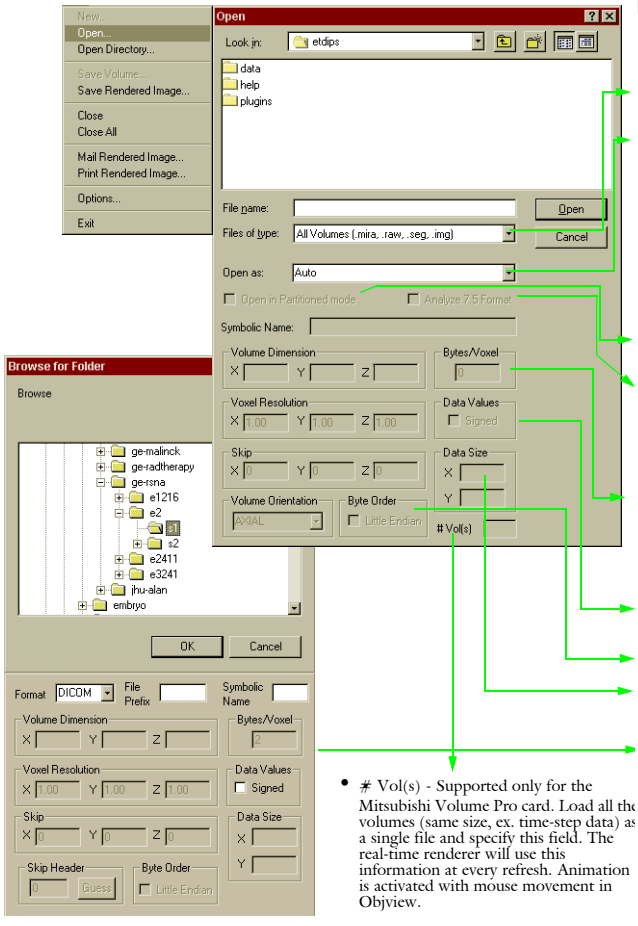
- Material Properties: Specular coefficient and specular power (Shininess), Diffuse and ambient properties (See effect of these parameters on human form in Object View.
- Front & Back Depth Cue
- Zoom: Pixel-level zoom of rendered image. zoom ∝ Time to render.
- Rays-per-voxel: Super-sampling in image plane to generate larger smother image. #rays ∝ Time to render.
- Samples-per-voxel: Super-sampling in depth. #samples ∝ Time to render.
- Surface Gradient: A special gradient computation filter to smooth out surfaces for rendering segmented datasets. Depth ∝ Time to render.
- Fast Skip: Set the level of pixelation for fast rendering. Skip ∝ 1/Time to render
- Average Parameter used in RayCast rendering.
- Confocal Rendering*: Depth beyond first hit surface to skip; Width through which to scale opacity; Depth Enhance: Defines opacity scaling func.

*Confocal Volume Rendering (CVR) operates only in F2B mode, Conf. Width = 0 turns off CVR & Conf. Depth = 0 is Auto depth calc.

File Open Controls

File Open Menu

- New: (Not implemented yet)
- Open: Load a volume dataset.
- Open Directory: Allows user to load in DICOM, RAW, TIFF, and BMP image stack by specifying the directory containing the data. See **`File Open Directory Panel`** below. For BMP/TIFF stacks, it allows user to specify the x, y, z voxel dimension. For RAW slice stacks, all parameters as in the Open dialog (See **`right`** column) are supported.
- Save Volume: Allows user to save the volume in MIRA, Raw, Slice (Raw or BMP) format.
- Save Rendered Image: To save a rendered image in BMP, RGB, BIN, BPM formats.
- Save Model: Save surface rendered models in OBJ, STL & Inventor(iv) formats
- Close: To remove/free one of the loaded volumes.
- Close All: To clear all volumes, volume references from memory.
- Mail Rendered Image: To mail the rendered image as an attachment. Invokes the MAPI protocol and so requires a MAPI activated mail client.
- Print Rendered Image: Print facility for the rendered image.
- Options: To set user preferences for Render Preview and colors of the console window.
- Exit: Quit Application

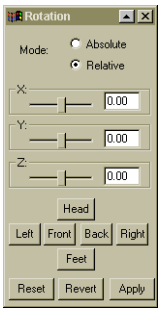


File Open/Open Directory Dialog

- Standard Windows File Open dialog for file selection.
- Select which files of the directory to list
- Option to open a file as a RAW volume, MIRA (Medical Image Rendering and Analysis: internal 3D data format) volume, Segmented volume (to act as an alpha/label channel), or an Anatomy map (linking intensity values in a volume to anatomical labels).
- Open in Pave mode: If checked the volume data is not loaded into memory and the rendering occurs in "partitioned mode". Also SliceViews are blank since data not in memory.
- Open as ANALYZE 7.5 format
- Symbolic Name: Reference name of volume to manage multiple volumes in memory.
- Volume Dimensions: For raw volumes, user must specify the x, y, and z size of the volume and the number of bytes/voxel.
- Voxel Resolution: To specify dimension of non-isotropic voxels
- Byte Order specification: Big Endian-UNIX (default)
- Skip - Data Size: To load part of a volume data file, specify the x, y, & z skip, and the actual slice x and y size.
- Open Directory Mode: Select directory which contains the volume as a collection of 2D images (DICOM, TIFF, BMP, RAW image stacks). Allows user to set the file prefix to use for selection and also offer to specify or guess the size of header to skip at the beginning of each slice.

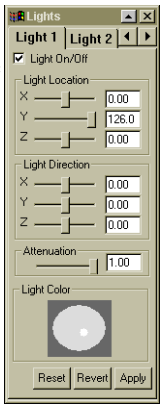
- # Vol(s) - Supported only for the Mitsubishi Volume Pro card. Load all the volumes (same size, ex. time-step data) as a single file and specify this field. The real-time renderer will use this information at every refresh. Animation is activated with mouse movement in Objview.

TOOLBOX CONTROLS



Rotation Dialog

- Allows either absolute rotation settings OR relative rotation of the object
- Absolute mode: X-, Y-, Z-rotation in dialog directly reflected in ObjView
- Relative mode: Any X-, Y-, or Z-rotation specified in dialog is incrementally added to the current rotation.
- Quick Mode: Pre-defined rotations for viewing the object from Front, Back, Left, Right, Top, or Bottom.
- Common to Surface and Volume rendering.

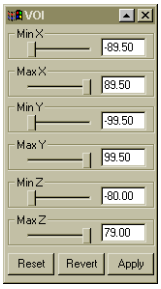


Light Dialog

- Specification of up to 4 light sources.
- Light ON/OFF
- Light location in ObjView Base coordinate frame, used to compute ONLY the direction of the light.
- Light Direction: Not Implemented Yet
- Attenuation: Not Implemented Yet
- Color: To specify Ambient, Diffuse and Specular color values for each light.
- Common to Surface and Volume rendering.

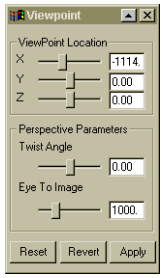
COMMON BUTTONS

- Reset: To return to default settings
- Revert: To last setting, works sparingly!
- Apply: Committed for rendering purposes.



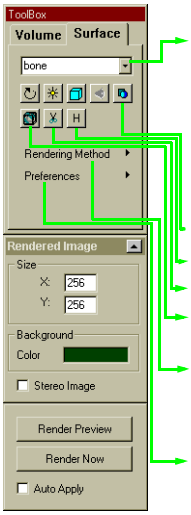
Volume-Of-Interest Dialog

- Based on the Base Coordinate frame in Object View OR the coordinate-axes in each of the SliceViews.
- Allows setting of MinX, MaxX, MinY, MaxY, MinZ, and MaxZ cut-planes.
- Common to Surface and Volume rendering.



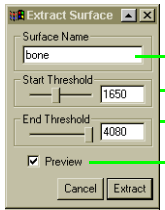
ViewPoint Dialog

- Operational in Volume rendering PERSPECTIVE mode ONLY.
- Allows specification of Eye-Point (x,y,z) location w.r.t. Base coordinate-axis of Object View.
- Eye-To-Image setting to define view volume/frustum.
- Twist Angle: Rotation of camera about the axis defined by the view-point and center of the volume.



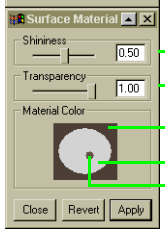
Surface Toolbox

- Selected surface name or World to select all surfaces.
- Rotation Control
- Lights
- Volume of Interest (VOI)
- ViewPoint (Not Implemented)
- Material Properties
- Show/Hide toggle
- Delete surface
- Surface Extraction from volume data
- Selection of rendering method (Shaded, Wireframe, point spread, directional transparency.
- Preferences: To select visibility of the coordinate axes and bounding box.



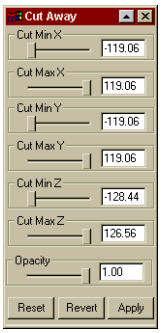
Surface Extraction Dialog

- Name of new surface to be extracted
- Lower threshold
- Upper threshold
- SliceView Preview



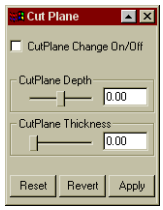
Surface Material Properties

- Material Shininess
- Transparency of selected surface
- Ambient, Diffuse, and Specular reflection colors for selected surface defining the material.



Cut Away Dialog

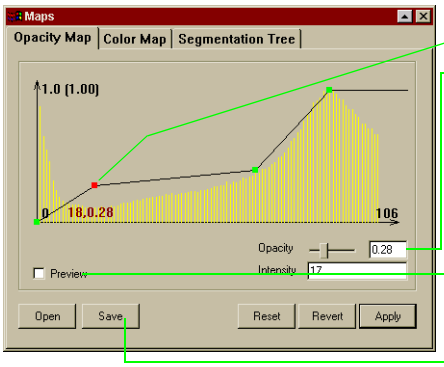
- Based on the Base Coordinate frame in ObjectView OR the coordinate-axes in each of the SliceViews.
- Allows setting of MinX, MaxX, MinY, MaxY, MinZ, MaxZ, and opacity within the selected region.
- Similar to cutplane specification.
- Available only for Hybrid mode rendering



Oblique Cut Plane

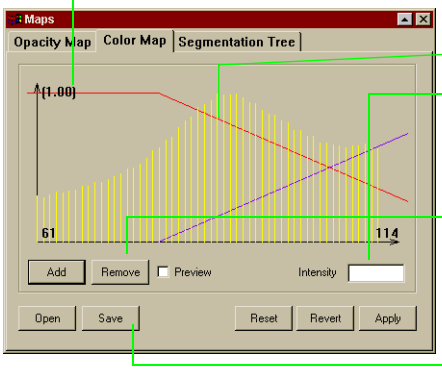
- Presently active only for Real-time render mode.
- Activate/Inactivate.
- Define the Cutplane depth
- Set Cutplane thickness.

Opacity, Color, and Segmentation Tree Controls



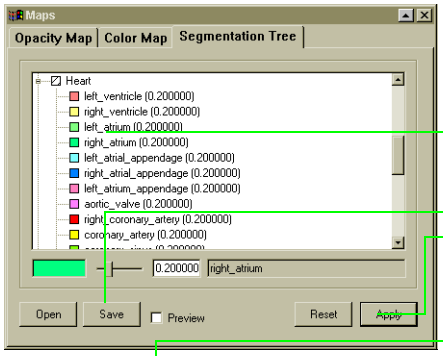
Opacity Map Controls

- Left Button: Insert new node and move node.
- Right Button: Delete node
- Fine controls using scroll bar and entry box.
- SliceView Preview: Maps the effect of multiplying the present voxel value with the corresponding opacity value in the Axial, Coronal, and Sagittal views.
- Applicable to all datasets as long as segmentation map not loaded in. For RGB datasets, the mapping is based on gray-value.
- SHIFT-Right Mouse Button (Zoom-in)
  CTRL-Right Mouse Button (Zoom-Out)
- CTRL-Left Mouse Button (Pan-Left)
  CTRL-SHIFT+LEFT Mouse Button (Pan-Right)
- Open/Save: Open existing opacity map or save present settings.
- Data histogram displayed.



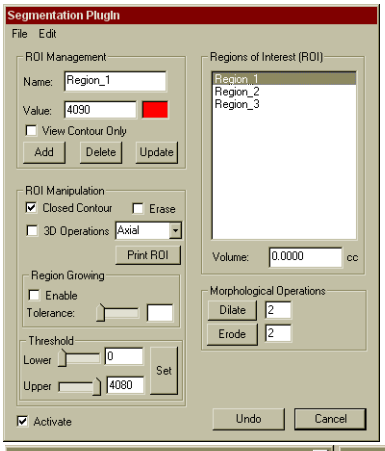
Color Map Controls

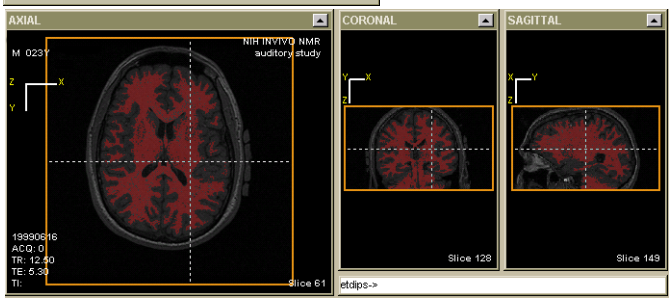
- Each trapezium defines the range of voxel intensity values which the user can select to define a material. Trapezium color represents material color.
- Edges represent mixture of materials, like tissue and bone.
- Left Button: Move node.
- Right Button: To open color palate
- Fine controls entry box.
- SliceView Preview: Maps the defined colormap into the Axial, Coronal, and Sagittal views. The actual color map is mapped to a 256 color OpenGL lookup table and so some colors may appear to be incorrect.
- Add/Remove: To add/delete the number of trapeziums/ material in the dataset.
- SHIFT-Right Mouse Button (Zoom-in)
  CTRL-Right Mouse Button (Zoom-Out)
- CTRL-Left Mouse Button (Pan-Left)
  CTRL-SHIFT+LEFT Mouse Button (Pan-Right)
- Open/Save: Open existing colormap or save present settings.
- Data histogram displayed.



Segmentation Tree

- Allows easy and selective rendering of segmented datasets. User can assign color and opacity to the region/label of choice.
- Labels organized hierarchically and can be each group of labels can be turned on/off.
- Color and opacity settings.
- Label Name
- SliceView Preview: Maps the defined colormap into the Axial, Coronal, and Sagittal views. The actual color map is mapped to a 256 color OpenGL lookup table and so some colors may appear to be incorrect if #labels > 256.
- Open/Save: Open existing colormap or save present settings.





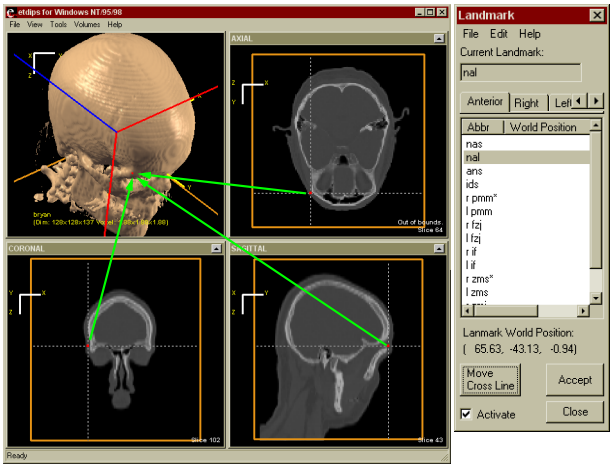
Segmentation Plug-in Controls

PLUG-IN END

- User can specify: ROI Name, intensity label and color used for overlay display.
- An ROI must be defined and selected to extract it from data. Hence, the user MUST specify the ROI details and Add a ROI to the list if ROIs. The user can also delete or Update/Edit the details of any ROI.
- Once a region is defined, only its contour can be viewed (For Axial view ONLY)
- ROI manipulation options: When manually sketching a ROI, option to close the contour;
  Erase Toggle ('e' Key in APPL. WINDOW);
  Perform actions on present slice or entire 3D data: If Not in 3D mode specify which plane to manipulate the ROI in A/C/S ERODE/DILATE the currently selected region
- 3D Region Growing: Is available as a tool to the user to define ROIs. This mode can enabled/disabled. A tolerance control is available to limit the growth of the region. When enabled hold SHIFT key down to Window/Level using left mouse button.
- Threshold operation: Allows user to set Lower/Upper thresholds values and "Set" extract the ROI based on them.
- Quantitative information [Volume (in cc)] of the segmented ROI is also available.
- UNDO option: 8-levels of undo for draw mode only. **Not available** for erase mode.
- Edit Menu: Options available to user:
  Merge ROI: At any stage the user may merge the segmented data with he original dataset for volume/surface rendering using etdips visualization capabilities. NOTE: In order to use this feature the user MUST (after the merge) open the Opacity/Colormap control and hit reset.
  Mask ROI: Use the current ROI to mask out a region from the volume and eliminate all else.
  Skull Strip: More an object extract option. User can define a ROI using Thresholding, Region growing, manually etc.; Then define a VOI using the VOI control to limit the extent of the object of interest, Move slice cursor (dashed line) to within the object of interest; and use skull strip option to pick out the one region connected to the point specified by the slice cursor.

APPLICATION END

- LEFT button (A/C/S views): Sketch ROI or specify SEED for 3D region growing.
- CTRL-RIGHT button (inside ROI): Fill ROI
- CTRL-SHIFT-RIGHT button (on ROI): Bleach/Delete ROI
- All original etdips fuctionality of the LEFT mouse button is accessible if SHIFT or CTRL are depressed (ex. Window/Level).



Landmark Plug-in Controls

PLUG-IN END

- The role of this plug-in is to offer the capability of picking a list of 3D points/coordinate in a volume dataset and allowing the use to store them to file.
- User can customize the GUI based by specifying the categories and landmark names in the "Landmark Name File". Points selected by the user are saved in the "Landmark Point File". These files can be loaded/saved from the GUI.
- User may also pick the 3D point on a polygonal surface extracted within etdips (3D Picking) by clicking the Right Mouse button on the Surface in the Surface Mode.
- Other options include moving the slice cursor (dashed line) to be at the user selected landmark point or edit and existing landmark.
- Once satisfied by the location of the landmark, accept associates it with a landmark name.

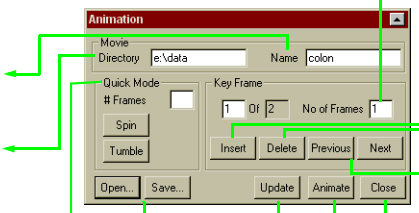
APPLICATION END

- Right button (A/C/S views): Select landmark in A/C/S views or Surface view on a extracted polygonal surface.
- CTRL-RIGHT button: Zoom; Reset in ObjView 3D.
- All original etdips fuctionality of the LEFT mouse button is accessible if SHIFT or CTRL are depressed.

Animation Controls

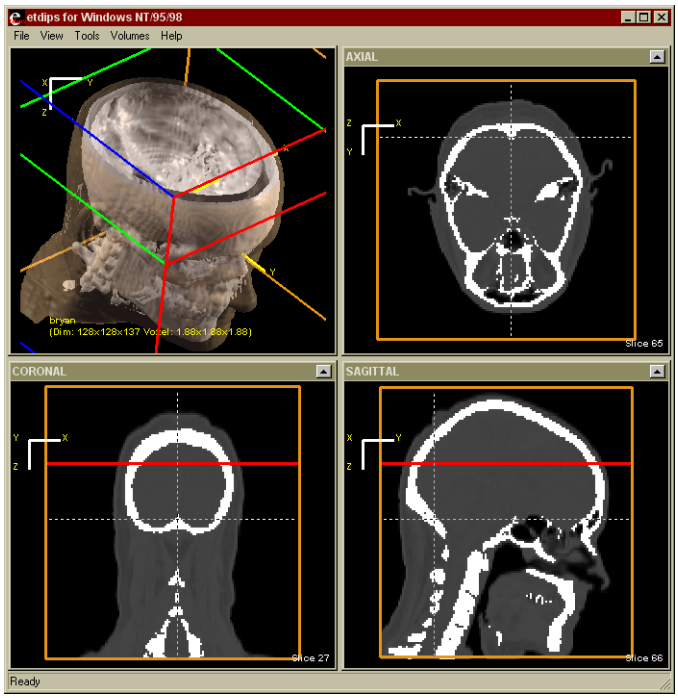
Key-Frame Specification

- Allows easy control and planning of animation sequences.
- Can be used for saving current work state.
- Name of the movie (Prefix for the file name of each frame)
- Directory: To specify the directory in which to save the key-frame file, animation log file, and the rendered image frames.
- Quick Mode: Specify total number of frames in the animation and hit Spin/ Tumble to create a 360 deg animation.
- Open/Save: To open an existing key-frame file or save the key-frames to file.



- No. of Frames: To specify number of frames in-between keyframe i and i+1. Each key-frame has an associated number of frames and this field should be 1 for the last key frame.
- Insert: After the user has defined all the parameters for a key-frame, one can insert this i^{th} frame into the key-frame stack.
- Delete: To remove the present (i^{th}) key-frame.
- Previous/Next: No switch between key-frames.
- Close: End animation settings
- Animate: To begin batch rendering of all frames defined by the key-frames
- Update: After switching to the i^{th} key-frame, parameters in it can be changes in the various dialogs and the key-frame updated to record the changes.

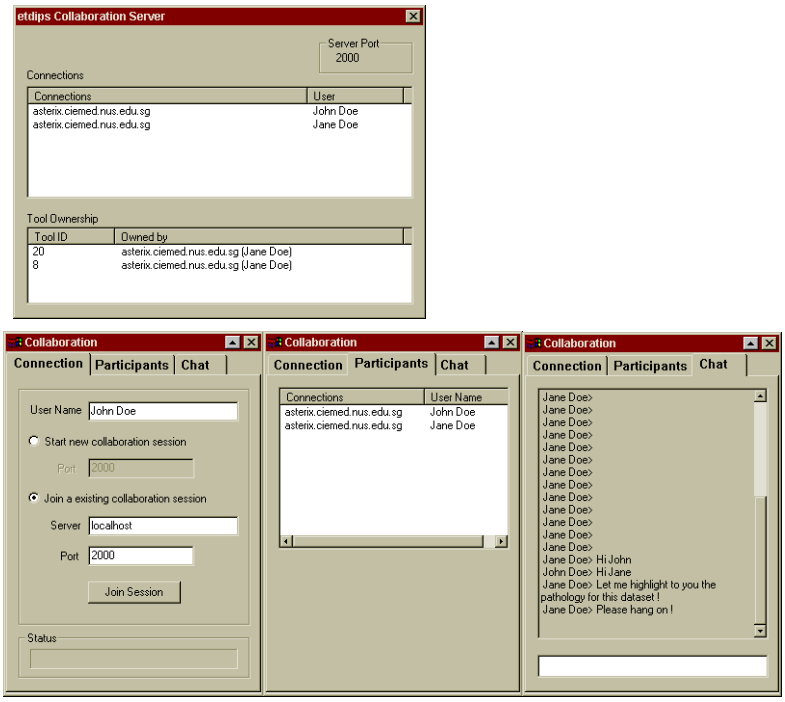
Surface Rendering Mode



Object View

- Multiple surface rendered objects are displayed in the Object View with option to Show/Hide coordinate axes and the bounding box.
- Lights (location and color) are shown as in the Volume Rendering mode.
- Present configuration allows independent rotation of each extracted surface.
- For comparative analysis the volume rendered image is also available in the interface.
- Upon switching between Volume and Surface modes, the parameters corresponding to system lights, VOI, and rotation are kept the same.
- CNTRL + LEFT mouse: Allows user to manipulate the world rotation, while Left Mouse rotates the selected surface.
- Extracted surfaces can be saved as OBJ (Wavefront), STL, and iv (Inventor) formats.

COLLABORATIVE VISUALIZATION & ANALYSIS



Collaboration Server

- Auto or manually started.
- Shows user in the present session and events/tools locked by them

Collaboration Client

- Accessible from the etdips **`Tools`** menu.
- Connection: Allows user to start a new collaborative session on a specific TCP/IP port or join in a currently active session.
- Participants: Shows the participants of the collaborative session.
- Chat: Chat support for text-based communication.

CAUTION:

- The present version expects all users to load same data AND before doing any other action connect to the collaborative session.
- Opacity/Colormap modifications and changing the present working dataset are not allowed.